

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
15 September 2005 (15.09.2005)

PCT

(10) International Publication Number
WO 2005/085520 A1

(51) International Patent Classification⁷: **D21F 1/02**

(21) International Application Number:
PCT/FI2005/050042

(22) International Filing Date: 22 February 2005 (22.02.2005)

(25) Filing Language: Finnish

(26) Publication Language: English

(30) Priority Data:
20040337 3 March 2004 (03.03.2004) FI

(71) Applicant (for all designated States except US): **METSO PAPER, INC.** [FI/FI]; Fabianinkatu 9 A, FI-00130 HELSINKI (FI).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **KIRVESMÄKI, Jarmo** [FI/FI]; Linkkikatu 36, FI-40640 JYVÄSKYLÄ (FI). **LAPPI, Janne** [FI/FI]; Lehtokatu 15 as 12, FI-40630 JYVÄSKYLÄ (FI).

(74) Agent: **FORSSÉN & SALOMAA OY**; Eerikinkatu 2, FI-00100 HELSINKI (FI).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— with international search report

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: VANE INTENDED FOR A HEADBOX OF A PAPER MACHINE AND METHOD FOR ENSURING THE STRAIGHTNESS OF A VANE

(57) Abstract: A vane intended for a headbox of a paper machine or equivalent, which vane is moistened and enclosed in a vapour-proof package to ensure the straightness of the vane. At least a portion of the vane is made of a water-absorbing material, such as plastic or a composite. Advantageously, the vane contains moisture in an amount that corresponds to the equilibrium moisture content of the vane in headbox conditions. It is enclosed in a package, preferably a vacuum package, the retains the moisture of the vane until the vane is put into use.



WO 2005/085520 A1

Vane intended for a headbox of a paper machine and
method for ensuring the straightness of a vane

- 5 The invention relates to a vane intended for a headbox of a paper machine or equivalent. The invention also relates to a method for ensuring the straightness of a vane intended for a headbox.

By the paper machine or equivalent is meant paper, board and soft tissue
10 machines.

Vanes are used in the slice channel of the headbox for damping large-scale turbulence and for converting it into small-scale turbulence to thereby prevent the formation of fibre bundles and improve the quality of the paper to be
15 manufactured. Vanes are also used in multi-layer headboxes for separating the different layers of flow from one another.

Vanes can be manufactured of metal, plastic or a composite composed of a binder and fibres embedded in the binder. They can be of equal thickness in cross-section or thinning in a wedge-like manner towards a trailing edge. The vanes are
20 attached by their leading edge, as viewed in the flow direction, to an attachment groove provided in the turbulence generator of the headbox, so that their trailing edge is able to float freely with the flow in the slice channel of the headbox. Between the vanes there are tapering flow channels, in which the velocity of the
25 pulp suspension accelerates towards the slice opening of the headbox. With respect to the uniformity and undisturbed state of the flow discharging out of the slice opening it is essential that the vanes placed in the slice channel of the headbox are straight and parallel.

30 It has been found that a vane made of plastic or a composite absorbs some water in the moisture and temperature conditions of the headbox, so that the dimensions

of the vane may change as a result of swelling. When a new wedge-shaped vane is fitted in the headbox, its thin trailing edge reaches an equilibrium moisture content much more quickly than the thick leading edge. This readily leads to the fact that the vane warps and undulation is produced in it, which adversely affects the quality of the paper being manufactured.

The temperature and moisture conditions during the manufacture, transport and storage of vanes are generally different from the operating conditions in the headbox. Vanes intended for the headbox have to be stored in varying conditions for varying periods of time before they are put into use. For the reasons set out above, vanes whose moisture content is different from the equilibrium moisture content of the vane during use in the headbox must be fitted in the paper machine. It may take several weeks to reach a state of equilibrium when vanes are put into use, and during that time the quality of paper readily suffers from the uneven shape of the vanes.

An object of the invention is to reduce the problems associated with the putting into use of a vane. In particular, it is an object to ensure that the vane retains its shape during storage and is ready for use immediately after it is fitted in a paper machine.

With a view to achieving this object, the vane according to the invention is characterized by what is stated in the characterizing part of claim 1. Similarly, the method according to the invention is characterized by what is stated in the characterizing part of claim 6.

To ensure the straightness of the vane, the vane is moistened, preferably already in connection with manufacture, and enclosed in a vapour-proof package. The vane is treated so that it contains moisture in an amount that corresponds to the equilibrium moisture content of the vane in headbox conditions. The vane is

enclosed in a package that retains the moisture of the vane until it is put into use. The package is preferably a vacuum package.

- 5 The length of the vane intended for the headbox generally corresponds to the width of the headbox, which may be, at its widest, as much as 11 m. The thickness of the leading edge of the wedge-shaped vane can be about 10 mm, while the thickness of its trailing edge is only about 0.5 mm. When the thin trailing edge absorbs moisture more quickly than the thick leading edge, stresses are readily produced in the vane, which causes deformations. This phenomenon can be avoided by moistening the vane in advance to a desired moisture content and by maintaining the vane moist. In tests it has been found that the change in the length of the vane as a result of moistening is of the order of 1.5 mm/m. Moistening increased the weight of the vane by about 1.5 %.
- 10
- 15 Moistened vanes packed in a vapour-proof manner remain straight during the time of storage and are immediately ready for use when taken out of the package. The invention enables water-absorbing materials to be used as a raw material for vanes.
- 20 The method for ensuring the straightness of vanes according to the invention is advantageous when considering the total costs of the vanes, possible technical arrangements to compensate for warping, and the benefits achieved in the behaviour of the vane, in particular when it is put into use.
- 25 The vanes can be manufactured in the usual manner, for instance, of plastic or of a composite material, after which they are impregnated with steam. The treatment can be accomplished, for example, using a steam chamber where vanes are stored for several weeks. The steam treatment can last, for example, 4-5 weeks at a temperature of 60-70 °C. The lower the temperature at which moistening is carried out, the longer the time needed for reaching the desired moisture level.
- 30

Alternatively, moistening can be accomplished by immersing vanes in hot water, for example, of 60-70 °C, for a sufficiently long period of time.

5 After the steam treatment, the vane is enclosed in a vapour-proof foil bag or in another equivalent package. The foil bag is provided with a vacuum and it is closed air-tightly. The closed package retains the moisture of the vane, whereby the vane remains straight. When the vacuum-packed vane is later put into use at a paper mill, an unbroken vacuum package indicates that the moisture content of the vane has remained the same as it was when the vane was packed in foil.

10

Advantageously, the vane is moistened immediately in connection with manufacture in the production plant which manufactures vanes, but there is nothing to prevent that the treatment is accomplished at some later stage.

15 Advantageously, the vane is made of a water-absorbing material, but there is nothing to hinder that the treatment is performed on vanes made of another material or of a combination of several materials.

20 Many variations of the invention are feasible within the scope defined in the claims presented next.

Claims

1. A vane intended for a headbox of a paper machine or equivalent, **characterized** in that it is moistened and, after moistening, it is enclosed in a vapour-proof package.
5
2. A vane as claimed in claim 1, **characterized** in that it is manufactured at least partially of a water-absorbing material, such as plastic or a composite.
- 10 3. A vane as claimed in claim 1 or 2, **characterized** in that it contains moisture in an amount that corresponds to the equilibrium moisture content of the vane in headbox conditions.
4. A vane as claimed in any one of the preceding claims, **characterized** in that it is enclosed in a package that retains the moisture of the vane until the vane is put into use.
15
5. A vane as claimed in any one of the preceding claims, **characterized** in that it is packed in a vacuum package.
20
6. A method for ensuring the straightness of a vane intended for a headbox of a paper machine or equivalent, **characterized** by the steps of moistening the vane and enclosing the moistened vane in a vapour-proof package.
- 25 7. A method as claimed in claim 6, **characterized** by the step of manufacturing the vane or at least a portion of it out of a water-absorbing material, such as plastic or a composite.
8. A method as claimed in claim 6 or 7, **characterized** by the step of moistening the vane to a moisture content that corresponds to its equilibrium moisture content in headbox conditions.
30

9. A method as claimed in any one of claims 6 to 8, **characterized** by the step of enclosing the vane in a package that retains the moisture of the vane until the vane is put into use.
- 5 10. A method as claimed in any one of claims 6 to 9, **characterized** by the step arranging a vacuum in the package containing the vane.
11. A method as claimed in any one of claims 6 to 10, **characterized** by the step of moistening the vane in connection with manufacture.
- 10 12. A method as claimed in any one of claims 6 to 10, **characterized** by the step of moistening the vane by keeping it in a steam atmosphere until its moisture content has reached a desired level.
- 15 13. A method as claimed in any one of claims 6 to 10, **characterized** by the step of moistening the vane by keeping it in a hot water bath until its moisture content has reached a desired level.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 2005/050042

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: D21F 1/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: D21F, B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 20030131964 A1 (ERIKSON ET AL), 17 July 2003 (17.07.2003), abstract, paragraphs [0049]-[0055] --	1-13
A	DE 4140097 A1 (4P FOLIE FORCHHEIM GMBH), 9 June 1993 (09.06.1993), claim 1, abstract -----	6-13

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 11 June 2005	Date of mailing of the international search report 20-06-2005
---	--

Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Nils Nordin/ELY Telephone No. +46 8 782 25 00
--	--

INTERNATIONAL SEARCH REPORT

Information on patent family members

30/04/2005

International application No.

PCT/FI 2005/050042

US 20030131964 A1 17/07/2003

US	6846386 B	25/01/2005
AU	2414301 A	09/07/2001
AU	7475801 A	02/01/2002
BR	0111649 A	01/07/2003
CA	2407913 A	27/12/2001
EP	1313911 A	28/05/2003
JP	2004501294 T	15/01/2004
SE	516634 C	05/02/2002
SE	0002338 A	23/12/2001
WO	0198583 A	27/12/2001
SE	0101368 D	00/00/0000

DE	4140097 A1	09/06/1993	NONE
----	------------	------------	------
